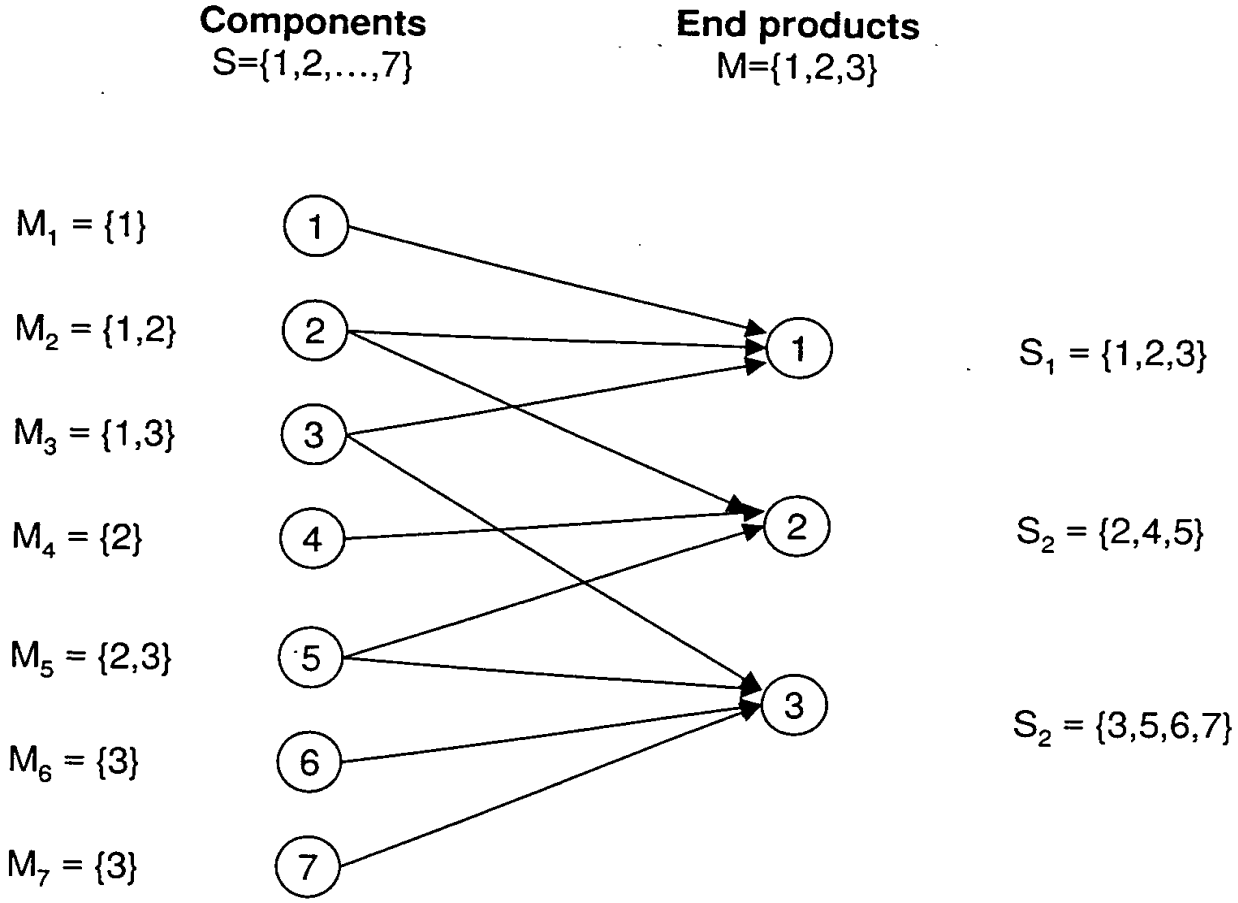
Components
S={1,2,...,7}
End products
M={1,2,3}
M1 = {1}
M2 = {1,2}
M3 = {1,3}
M4 = {2}
M5 = {2,3}
M6 = {3}
M7 = {3}
1
2
3
4
5
6
7
1
2
3
S1 = {1,2,3}
S2 = {2,4,5}
S2 = {3,5,6,7}

Figure 1

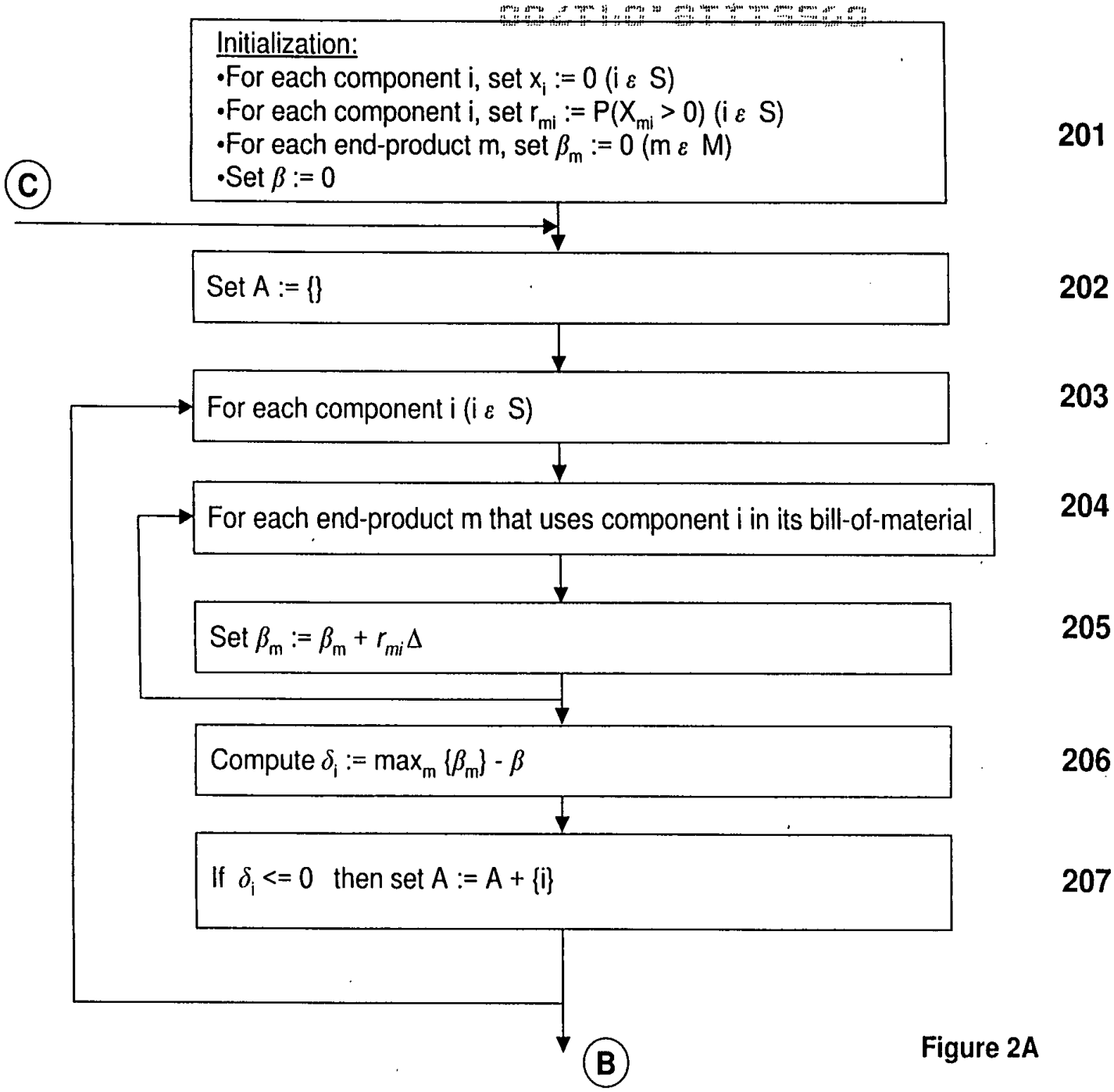
Initialization:
•For each component i, set $x_i := 0$ ($i \varepsilon S$)
•For each component i, set $r_{mi} := P(X_{mi} > 0)$ ($i \varepsilon S$)
•For each end-product m, set $\beta_m := 0$ ($m \varepsilon M$)
•Set $\beta := 0$
201
C
Set A := {}
202
For each component i ($i \varepsilon S$)
203
For each end-product m that uses component i in its bill-of-material
204
Set $\beta_m := \beta_m + r_{mi}\Delta$
205
Compute $\delta_i := \max_m \{\beta_m\} - \beta$
206
If $\delta_i <= 0$ then set A := A + {i}
207
B

Figure 2A

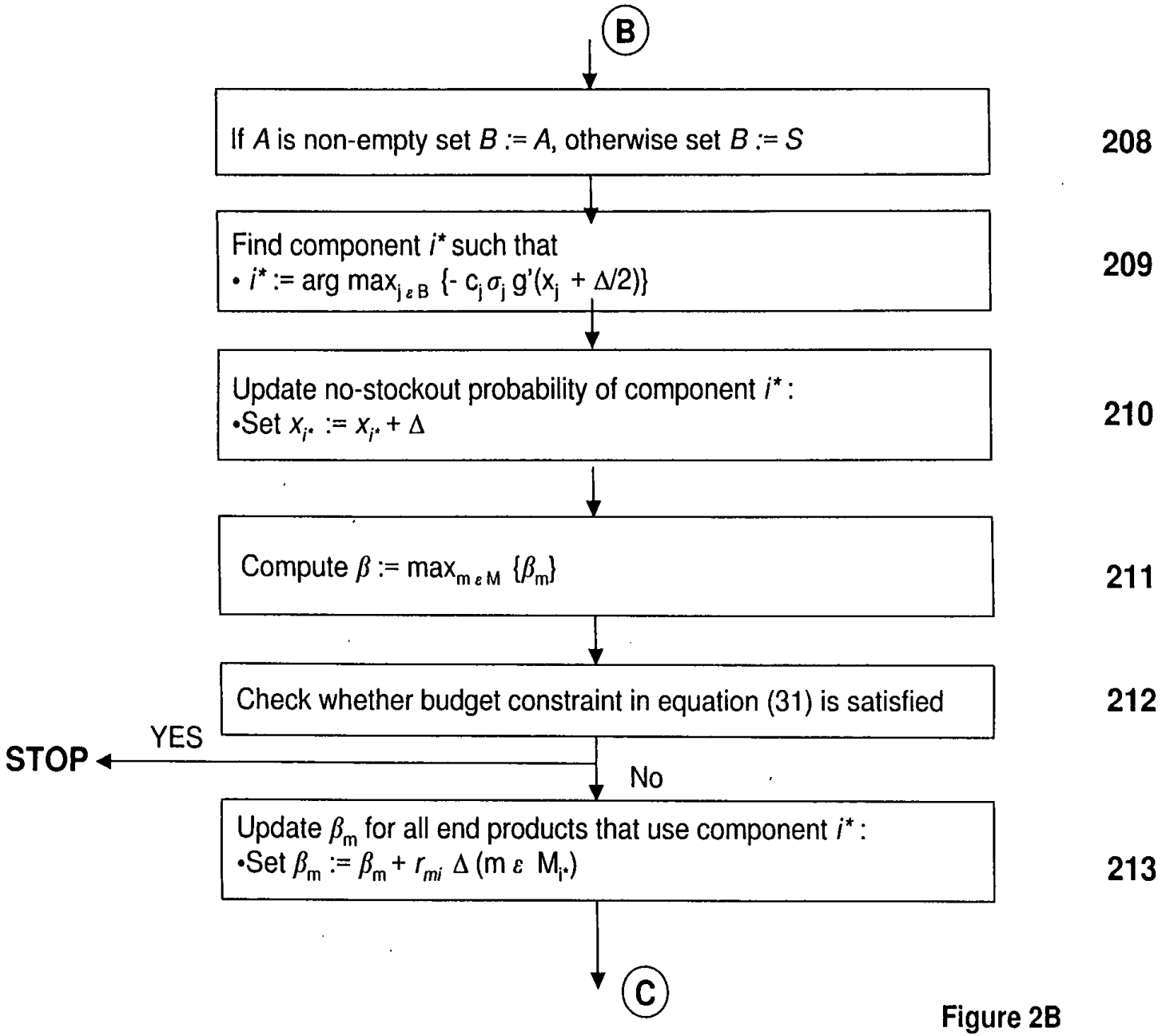
B
If A is non-empty set B := A, otherwise set B := S
208
Find component i* such that
• i* := arg max_{j ε B} {- c_j σ_j g'(x_j + Δ/2)}
209
Update no-stockout probability of component i* :
•Set x_{i*} := x_{i*} + Δ
210
Compute β := max_{m ε M} {β_m}
211
Check whether budget constraint in equation (31) is satisfied
212
YES
STOP
No
Update β_m for all end products that use component i* :
•Set β_m := β_m + r_{mi} Δ (m ε M_{i*})
213
C

Figure 2B

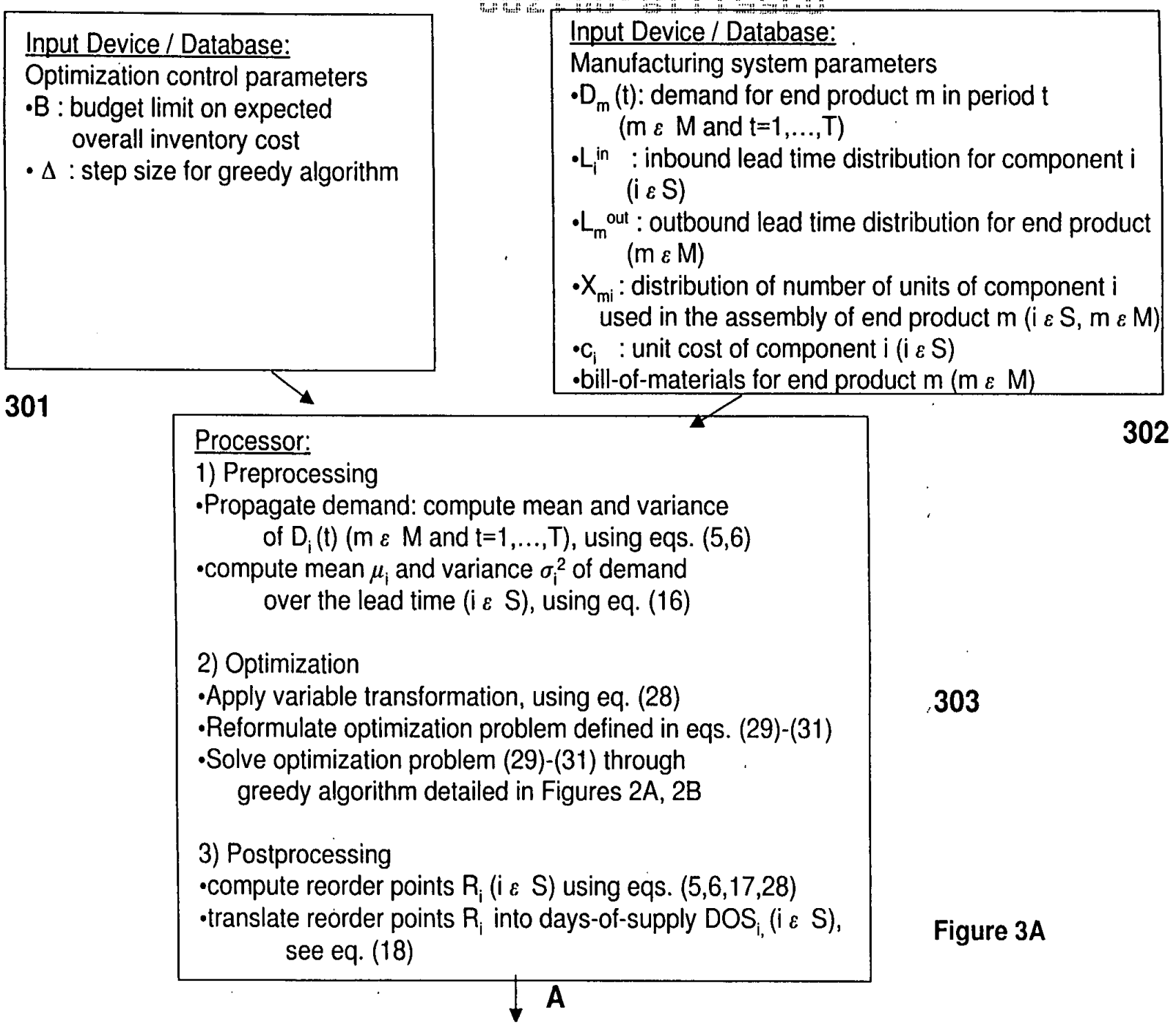
Input Device / Database:
Optimization control parameters
•B : budget limit on expected overall inventory cost
• Δ : step size for greedy algorithm
301
Input Device / Database:
Manufacturing system parameters
•D_m (t): demand for end product m in period t (m ε M and t=1,...,T)
•L_i^{in} : inbound lead time distribution for component i (i ε S)
•L_m^{out} : outbound lead time distribution for end product (m ε M)
•X_{mi} : distribution of number of units of component i used in the assembly of end product m (i ε S, m ε M)
•c_i : unit cost of component i (i ε S)
•bill-of-materials for end product m (m ε M)
302
Processor:
1) Preprocessing
•Propagate demand: compute mean and variance of D_i (t) (m ε M and t=1,...,T), using eqs. (5,6)
•compute mean μ_i and variance σ_i^2 of demand over the lead time (i ε S), using eq. (16)
2) Optimization
•Apply variable transformation, using eq. (28)
•Reformulate optimization problem defined in eqs. (29)-(31)
•Solve optimization problem (29)-(31) through greedy algorithm detailed in Figures 2A, 2B
3) Postprocessing
•compute reorder points R_i (i ε S) using eqs. (5,6,17,28)
•translate reorder points R_i into days-of-supply DOS_i (i ε S), see eq. (18)
303
A

Figure 3A

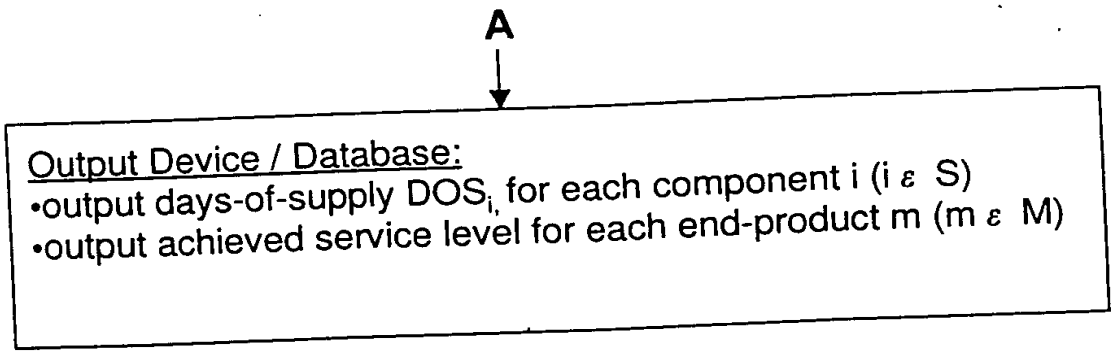
A
Output Device / Database:
•output days-of-supply DOS_i, for each component i (i ε S)
•output achieved service level for each end-product m (m ε M)
304

Figure 3B

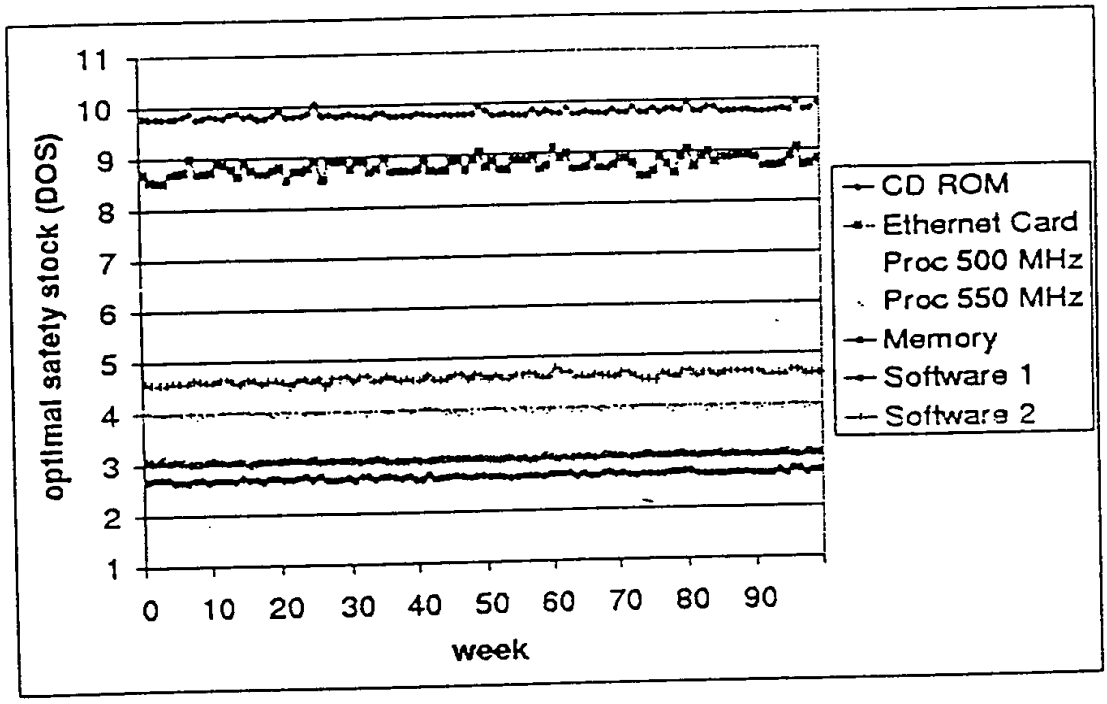
optimal safety stock (DOS)
11
10
9
8
7
6
5
4
3
2
1
0
10
20
30
40
50
60
70
80
90
week
CD ROM
Ethernet Card
Proc 500 MHz
Proc 550 MHz
Memory
Software 1
Software 2

FIG. 4

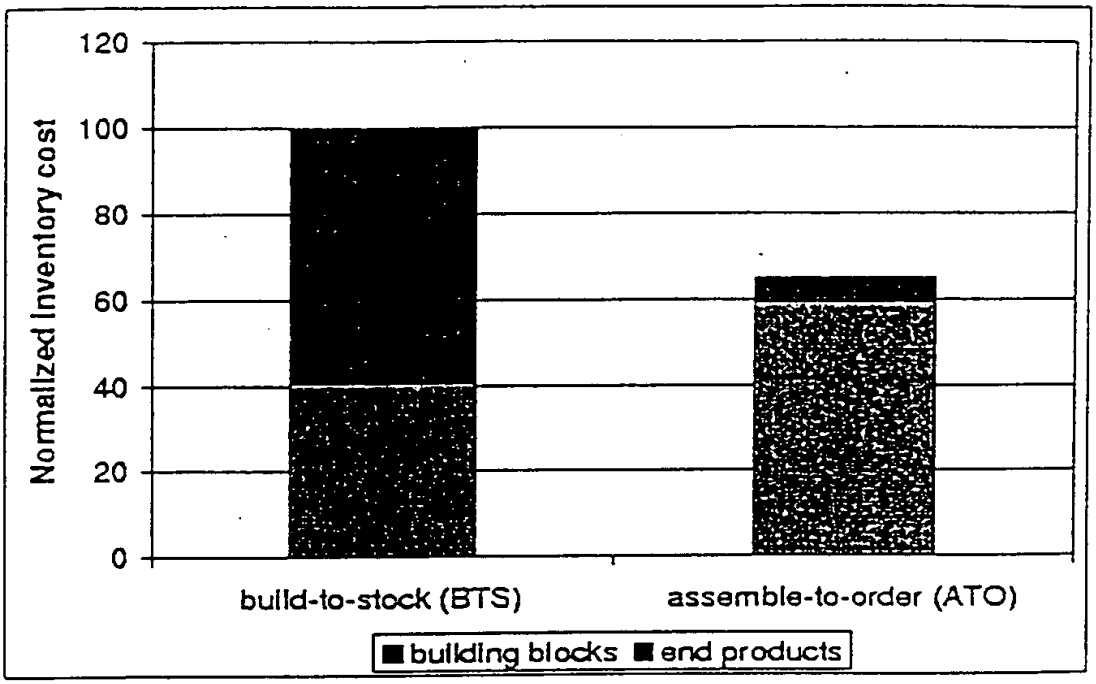
120
100
80
60
40
20
0
Normalized Inventory cost
build-to-stock (BTS)
assemble-to-order (ATO)
building blocks
end products

FIG. 5

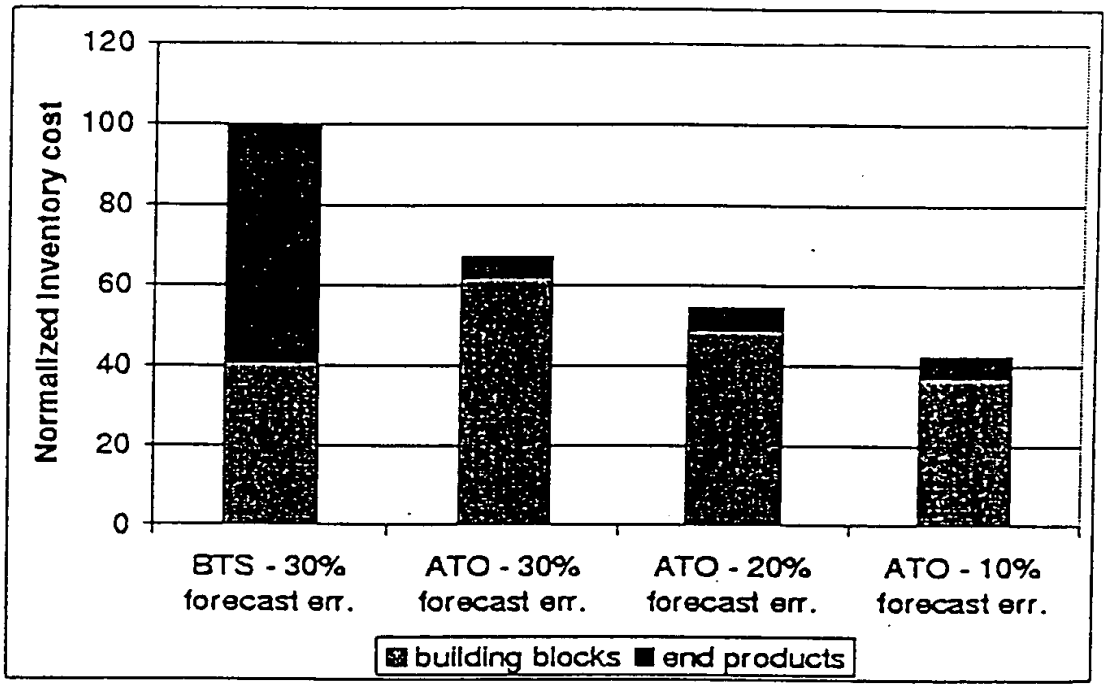
120
100
80
60
40
20
0
Normalized inventory cost
BTS - 30% forecast err.
ATO - 30% forecast err.
ATO - 20% forecast err.
ATO - 10% forecast err.
building blocks
end products

FIG. 6

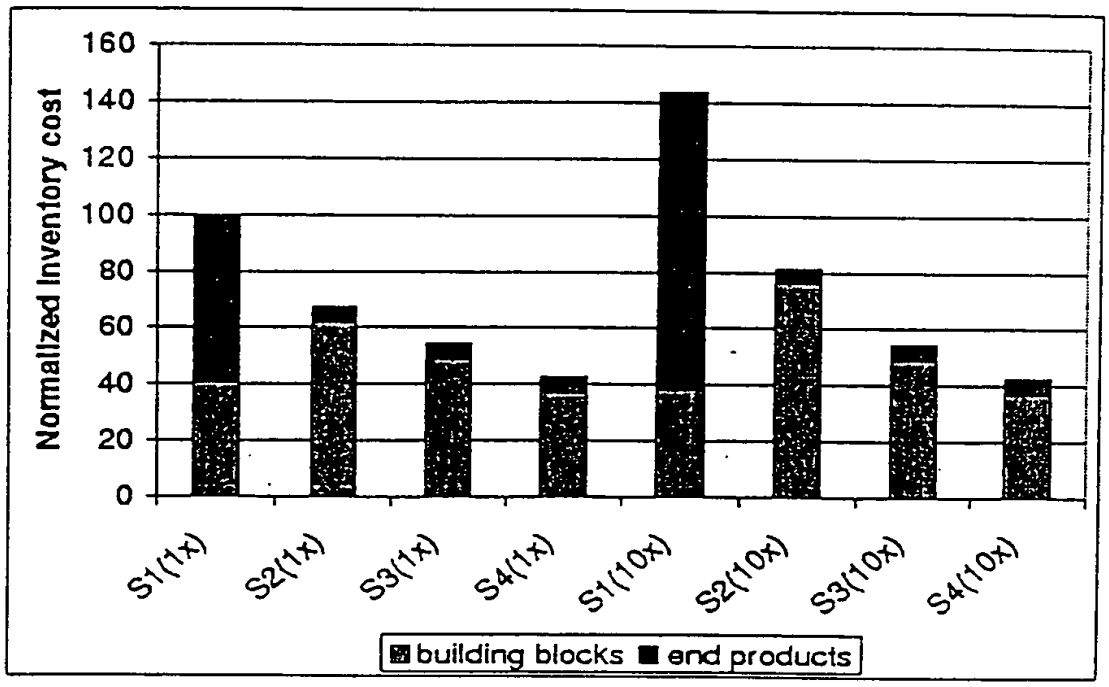
Normalized Inventory cost
160
140
120
100
80
60
40
20
0
S1(1x)
S2(1x)
S3(1x)
S4(1x)
S1(10x)
S2(10x)
S3(10x)
S4(10x)
building blocks
end products

FIG. 7